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ABSTRACT

This document is made up of materials supporting a presentation about a program designed to encourage freshman and sophomore high school mathematics students to use the school library to research famous mathematicians. The handouts that compose the document are: (1) a description of the assignment, "Conversations with Mathematicians"; (2) a list of mathematicians to be researched; (3) a bibliography for student researchers; (4) a worksheet and recommended resources on using the library for mathematics; (5) a list of the "Librarian's Ten Commandments"; (6) a brief paper describing a systematic approach to teaching critical thinking skills written from the point of view of the media specialist; and (7) a bibliography of 24 recommended books for research on famous mathematicians. (KRN)

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CONVERSATIONS WITH MATHEMATICIANS

by Madeleine M. Hoss

and

Carol G. Ropp

1120544132

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Conversations with Mathematicians

This is an oral presentation, not really a paper read.

In summary,

This unique program involving a Mathematics teacher and Librarian was conceived by Madeleine Hoss, librarian at Zimmerman Library, Metcalf Laboratory School, Illinois State University, Normal, Illinois U.S.A. The program implements library research skills into the Mathematics curriculum.

Forty-four freshman and sophomores students of Carol Ropp's Mathematics classes at University High School, Illinois State University, Normal, Illinois, researched and wrote a paper on the background, works and the impact of a famous mathematicians of the world. Then they acted out the role of the mathematician they researched. They interviewed each other in the first person while dressed in the costume of the mathematician. Each interview was video taped. This is a clever way to get students involved in reading, research, and using the library in a fun way researching, and using the library in a fun way.

Mrs. Hoss' goal was to get the kids into the library. Mrs. Ropp's goal was to get her math students to learn about famous mathematicians. As a result of this program. Mrs. Ropp is convinced that she should have her Mathematics students using the library more often.

Handouts include the exact format of the papers and interviews, suggested book list for researching mathematicians, The Librarians Ten Commandments,two page worksheet on using the library for Mathematics, and A systematic approach to Critical Thinking skills.

Presentation includes a video taped presentation of the student mathematicians and explanation of the handouts.

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Mathematics students using the library ?

You've got to be kidding!

Collaboration is a MUST!

Teamwork is a must!

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Librarian/Media Specialist

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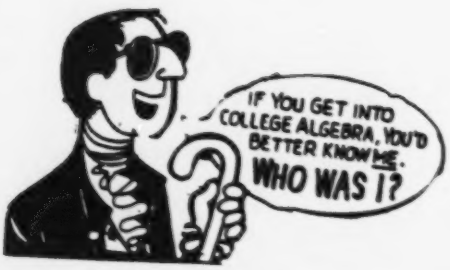

Implementing Library Research Skill
in the Mathematics Curriculum

" Conversations with Mathematicians "

Project: An interview with a famous mathematician - Research on their background and their work, especially their contributions to mathematics and its impact on the world.

1. Students will research in University High School Library, the Public Libraries, and Illinois State University Milner Library.

2. The following sources are required:
   a. Book - two sources
   b. Periodical - one source
   c. Bibliography (Use the Basic English Revisited book for correct format)

3. Reports will be graded according to the following criteria:
   a. 15 points - ability to follow instructions and use of time
   b. 40 points - content of report, how well you covered your Mathematicians background, work, etc.
   c. 10 points - completion of bibliography
   d. 35 points - interview techniques - how well you performed as interviewer and person interviewed

   100 points total

4. Presentations:
   You are to be the mathematician interviewed and will present your interview in the first person. Costumes are encouraged, and all presentations will be video taped. You are also to play the role of the interviewer for someone else.

5. Due dates
   Thursday, May 9, Library investigation Day. (draw the name of your mathematician and begin research)

   Friday ,May10 (U High), and Monday May 13 (Milner): Library research days.
   Thursday, May 16, interviews begin and video taping begins.

6. Interviews should last 3-5 minutes and reports should be 1-2 pages typed double spaced - they can be longer if you desire.

Archimedes

Rene Descartes

Carl Friedrich Gauss

Blaise Pascal

Gottfried Wilhelm Leibniz

Euclid

Grace Murray Hopper

Hypatia

Marie Sophie Germain

John von Neumann

Pythagoras

Leonard Euler

Pierre Fermat

Isaac Newton

Leonard Fibonacci

Georg Friedrich Riemann

Nikolai Lobachevsky

Emmy (Amalie) Noether

Marie Gaetana Agnesi

Mary Fairfax Somerville

Sonya Vasilevn Korvin-Kovalevskaia

Bertrand Russell

Excellent Books for Famous Mathematicians Research

Women

Olsen, Lynn M. Women in Mathematics. The MIT Press 1974

Perl, Teri. Math Equals. Addison-Wesley Publishing Company: Massachusetts, 1978.

Campbell, Paul J and Grinstein, Louise S. Women of Mathematics. Greenwood Press: New York, 1987

Marquis. Who's Who in Science. Western Publishing Co. 1968

Eves, Howard W. In Mathematical Circles. Prindle, Weber, and Schmidt, Inc.: 1969

Men

Bell. E. T. Men of Mathematics. Simon and Schuster, New York. 1965

Abbot, David. The Biographical Dictionary of Scientists and Mathematicians. Great Britain: Blond Educational, 1985

Newman, James. The World of Mathematics. New York, 1956

Smith, David. History of Mathematics. Boston, 1925

Mathematics. LIFE Science Library.Time, Inc. 1963

Hollingdale, Stuart, Makers of Mathematics. Penguin Books. London: 1989

Using the Library for Mathematics

The development of mathematics has involved many people and many different topics. Use your library to discover the answers to the following.

2. With the help of her sister, Aniuta, the Russian woman pictured at the right arranged a marriage of convenience so that she could go to Berlin to study with the mathematician Karl Weierstrass. She was awarded one of the first doctorates in mathematics in 1874 from the University of Göttingen. She taught primarily in Sweden and died there. Who is this mathematician whose initials are S. K.?

   _____

3. In Germany, the ludolphine number is so identified because of the work of Ludolph van Ceulen, who tried to find an accurate estimate of the number. What is the ludolphine number? _____

4. A vingintillion is the name given to 10^{63}. What is the name given to 10^{googol}? _____

5. The computer language ADA was named for Ada Lovelace, the daughter of what famous poet?

   _____

6. The ENIAC was developed to compute firing tables for artillery. It was designed at the Moore School of Electrical Engineering of the University of Pennsylvania by J. Presper Eckert and John W. Mauchley in cooperation with Herman H. Goldstine of Army Ordnance for the Ballistic Research Laboratory, Aberdeen, Maryland, in 1946. What does ENIAC stand for? _____

7. Benoit B. Mandelbrot coined a word in 1975 as a convenient label for irregular and fragmented self-similar shapes. What is this word? _____

8. The results of studies of soap bubbles and experiments on soap film were used by what architect to design the roofs of several buildings for the 1972 Olympic Games in Munich? _____

9. A Sierpinski gasket is formed by removing successively smaller equilateral triangles from an equilateral triangle. What is the area of a Sierpinski gasket? _____

10. The four-color-map problem was solved in 1976 by Kenneth Appel and Wolfgang Haken of the University of Illinois. What was the problem, who first proposed it, and how was it solved? _____

    _____

    _____

11. What was Alan Turing's contribution to mathematics? _____

    _____

12. Who was the first woman elected to the National Academy of Sciences in the United States, and when was she elected? _____

13. *Aleph null* is a term invented by whom and for what purpose? _____

    _____

14. A "mathematician's mathematician," this person came from India to England in 1914 to study mathematics with Godfrey H. Hardy and developed a notebook of some six thousand theorems of algebra, trigonometry, calculus, and analytic geometry. He died of tuberculosis in 1920 at the age of 33. Who was he?

    _____

Using the Library for Mathematics—Continued

15. Nicolas Bourbaki is the pseudonym of a famous collection of mathematicians who worked in what country? _____

16. The author of the children's book *Alice in Wonderland* was also a logician. Who was he, and under what pseudonym did he write? _____

17. This twentieth-century mathematician, originally from Budapest, who wrote *How to Solve It* and might be considered a parent of problem solving, was a professor emeritus at Stanford University before his death. Who was he? _____

18. The Mayans invented a highly developed number system. What was the base of that number system? _____

19. What mathematician had such a personal and professional concern for her students that in Göttingen her students were called "the Noether boys"? _____

20. What career naval officer was a primary developer of the computer language COBAL? _____

21. Emilie du Châtelet, an associate of Voltaire, did her mathematical work in what country? _____

22. Match the following mathematicians with an area of mathematics for which they are known and today's name of their country.

(*a*) René Descartes	Non-Euclidean geometry	England
(*b*) Euclid	Logic	USSR
(*c*) Simon Stevin	Complex numbers	Hungary
(*d*) Karl Friedrich Gauss	Plane Geometry	France
(*e*) Georg Cantor	Decimals	Netherlands
(*f*) Nikolai Lobachevski	Coordinate systems	Greece
(*g*) Charlotte Angas Scott	Transfinite numbers	Germany
(*h*) Bertrand Russell	Game theory	England
(*i*) Isaac Newton and Gottfried Leibniz	Algebra	USSR
(*j*) Al-Khowarizmi	Calculus	England and Germany
(*k*) Benjamin Banneker	Twenty-three problems	Germany
(*l*) David Hilbert	Coeditor, *American Journal of Mathematics*	United States
(*m*) John von Neumann	Almanac writer	Germany

Did you know that . . .

- Pythagoras was given credit for most mathematical discoveries made by his colleagues?
- Pascal did not develop Pascal's triangle?
- Sophie Germain wrote under the pen name M. LeBlanc so that no one would know that she was a woman?
- Niccolò Tartaglia had his major mathematical work stolen by Jerome Cardan?

Did you know that—Continued

- linear programming was developed to assist in the war effort in the 1940s?
- Indiana tried to legislate a rational-number value for π?
- an American president developed an original proof of the Pythagorean theorem?
- Archimedes wrote a book titled *The Sand Reckoner*?

Can you . . .

- identify where the symbols $=$, $+$, $-$, $\times$, and $\sqrt{\ }$ originated?
- find examples of mathematicians having named for them discoveries that other people ascertained first?
- find five sources for mathematics history in your school library?
- "square a circle" with a compass and straightedge?
- identify the country in which the metric system originated? Is the system legal in the United States?
- find the origin of the term *absolute value*?

Bibliography

Adele, Gail H. "When Did Euclid Live? An Answer Plus a Short History of Geometry." *Mathematics Teacher* 82 (September 1989):460–63.

Arndt, A. B. "Al-Khwarizmi." *Mathematics Teacher* 76 (December 1983):668–70.

Boyer, Carl B. *A History of Mathematics*. Princeton: Princeton University Press, 1985.

Diana, Lind Mae. "The Peruvian Quipu." *Mathematics Teacher* 60 (October 1967):623–28.

Fabricant, Mona, Sylvia Svitak, and Patricia Clark Kenschaft. "Why Women Succeed in Mathematics." *Mathematics Teacher* 83 (February 1990):150–54.

Feldmann, Richard W., Jr. "The Cardano-Tartaglia Dispute." *Mathematics Teacher* 54 (March 1961):160–63.

Kenschaft, Patricia C. "Charlotte Angas Scott, 1858–1931." *College Mathematics Journal* 18 (March 1987):98–110.

Kimberling, Clark. "Emmy Noether, Greatest Woman Mathematician." *Mathematics Teacher* 75 (March 1982):246–49.

May, Kenneth O. "The Origin of the Four-Color Conjecture." *Mathematics Teacher* 60 (May 1967):516–19.

Mulcrone, T. F., S. J. "Benjamin Banneker, Pioneer Negro Mathematician." *Mathematics Teacher* 69 (February 1976):155–60.

Osen, Lynn. *Women in Mathematics*. Cambridge: MIT Press, 1974.

Perl, Teri. *Math Equals: Biographies of Women Mathematicians Plus Related Activities*. Menlo Park, Calif.: Addison-Wesley Publishing Co., 1978.

Peterson, Ivars. *The Mathematical Tourist: Snapshots of Modern Mathematics*. New York: W. H. Freeman & Co., Publishers, 1988.

Reid, Constance. "The Autobiography of Julia Robinson." *College Mathematics Journal* 17 (January 1986):2–21.

Rowe, David E., and John McCleary, eds. *The History of Modern Mathematics*. Vols. 1 and 2. Boston: Academic Press, 1989.

Strauss, Aaron. "ENIAC: The First Computer." *Mathematics Teacher* 69 (January 1976):66–72.

Struik, Dirk J. *A Concise History of Mathematics*. 3d rev. ed. New York: Dover Publications, 1967.

Swetz, Frank J. "Using Problems from the History of Mathematics in Classroom Instruction." *Mathematics Teacher* 82 (May 1989):370–77.

Williams, Richard H., and Roy D. Mazzagatti. "Mathematical Firsts—Who Done It?" *Mathematics Teacher* 79 (May 1986):387–91.

Answers

1. (*a*) Napier's bones, multiplication; (*b*) Abacus, manual four-function calculation; (*c*) Vernier caliper, measuring small objects; (*d*) Dice, random-number generation; (*e*) Slide rule, scientific computation; (*f*) Compass, drawing arcs; (*g*) Quipu, early Peruvian computation; (*h*) Pantograph, drawing similar figures
2. Sonya Kovalevski
3. π
4. Googolplex
5. Lord George Byron
6. Electronic Numerical Integrator and Computer
7. Fractal
8. Frei Otto
9. 0
10. The question is whether four colors are always sufficient to color every conceivable map that can be drawn on a flat surface so that no countries sharing a common boundary are the same color. This problem was posed by Francis Guthrie about 1850 and eventually solved with a computer in 1976.
11. The development of a universal mathematics machine
12. Julia Robinson, 1975
13. Georg Cantor, the cardinal number of the set of natural numbers
14. Srinivasa Ramanujan
15. France
16. Charles L. Dodgson, or Lewis Carroll
17. George Pólya
18. Almost base twenty
19. Emmy Noether
20. Grace Hopper
21. France
22. (*a*) Coordinate systems, France; (*b*) Plane geometry, Greece; (*c*) Decimals, Netherlands; (*d*) Complex numbers, Germany; (*e*) Transfinite numbers, Germany; (*f*) Non-Euclidean geometry, USSR; (*g*) Coeditor, *American Journal of Mathematics*, England; (*h*) Logic, England; (*i*) Calculus, England and Germany; (*j*) Algebra, USSR; (*k*) Almanac writer, United States; (*l*) Twenty-three problems, Germany; (*m*) Game theory, Hungary

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LIBRARIANS TEN COMMANDMENTS

I. Thou shalt make your domain the heart of the school. It must be furnished with all kinds of needed materials tailored for your users.

II. Thou shalt make your domain the PR of the school. The community must be aware of your existence. Public awareness is a must and a plus. Remember, PR is not a word but a deed.

III. Thou shalt be involved in all curriculum meetings and discussions. Remember thou art the core of the educational information. Your job is to collect, organize and disseminate knowledge to all users of your domain.

IV. Thou shalt be known as a patriot and a savior for thou shalt be the answer to save your country from the national embarrassment of illiteracy. Thou shalt be the answer to the prayers of all the users of your domain.

V. Thou shalt contribute to efforts aimed at an up-to-date school program for today's youth. Remember, your primary job is to create, implement, enrich, and support the educational program of your school.

VI. Thou shalt collaborate with the interested faculty. Teamwork is vital for the integration and implementation of the research library skills into the curriculum.

VII. Thou shalt be innovative, enthusiastic, and creative to help promote your library services. Whatever the service you give to your students makes the greatest impression on your community.

VIII. Thou shalt be respected and supported, and appreciated by your fellow workers for your productive ideas to help promote citizenship, individual growth, ethical character, career guidance, skills, etc. . .

IX. Thou shalt and must change your 'COLD' image. You must overcome what the media has painted of you.

X. Thou shalt be known to instruct for life-long learning and encourage the life-long usage of the libraries.

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IS THIS TRUE?

TOO MUCH TO DO AND
TOO LITTLE TIME TO DO IT...

WHAT WE DO:

AV CLUB	STORY HOUR	SHELVE BOOKS
TEACH ENGLISH	CREATE PROGRAMS	SHELVE MAGAZINES
AV DIRECTOR	REPAIR MATERIAL	COMPUTER SOFTWARE
BUDGET	STUDY HALLS	DISTRICT LAMINATING
VERTICAL FILE	NEW BOOKS	AV HARDWARE
BOOK TALKS	TEXTBOOKS	STUDENT XEROXING
ADVISOR	ESL STUDENTS	PROVIDE IN-SERVICE
OVERDUES	WEEDING	BIBLIOGRAPHY LISTS
PROCESS BOOKS	DRAMA CLUB	GIFTED PROGRAM
REVIEWS	ORDERING	CONSULT WITH TEACHERS
LIBRARY SKILLS	BOOKSTORE	SALESMEN
COMPUTER SKILLS	SUPERVISE AIDES	INSTRUCT VOLUNTEERS

AND MEET WITH TEACHERS TO DEVELOP PROGRAMS THAT PROMOTE USE OF THE LIBRARY...

The What, Where, and How: A Systematic Approach to Critical Thinking Skills

All school librarians are aware of what is expected of them in the running of the library media center. Librarians' prime objective and what is expected of them is the teaching of research skills. These skills are needed to develop the abilities of students so they may become independent users of the library media center, explore and discover the wealth of materials available in the center, and continue to strengthen their academic studies.

It is important for media specialists to recognize the fact that they alone cannot teach research skills. Basic school curricula must be integrated with instructional techniques, and the librarian needs to develop a close relationship with the teachers. These relationships allow the chance to build library skills into classroom projects, yet make the research fun for students.

University High School starts teaching these skill to freshmen in the fall semester. Freshmen are made aware of how to research through an orientation they receive in the library. The students then implement these new found skills by use of a research project provided by the teachers in the science department. Students learn systematic approaches for problem solving while developing critical thinking skills through their project and the research they do in the media center.

Consider the following Japanese proverb:

> Give a man a fish and he will not be hungry for a day. Teach him how to fish and he will not be hungry for a lifetime.

By developing a students ability for problem solving through critical thinking skills, librarians and teachers are building skills a student will use for a lifetime.

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There are three steps involved when teaching research skills, and they are: "What, Where, and How."

The "What" recognizes the fact that a student needs to define the subject or main topic of the research. If a student does not have a well defined subject matter, the project may become too broad of an area for a student to research.

Students need to develop their "Where" when building up research materials for projects and problems. It is up to the student to determine if there is a need for more information when dealing with a topic. There are many places a student can go to for materials; some of these places are: government agencies, school libraries, public libraries, and colleges. These outlets are full of interesting and recent research materials.

Through orientation in the library media center and classroom projects, students will develop the "How" for reporting research materials. Students will know how to find information and record the material; after much practice, a student will have the knowledge to recognize how a quote or paraphrase should be written and recorded in the project, and at the end of the assignment the student will know who to format the bibliography and list of sources. The implementation of this "know-how" will allow a student to create a project which is written properly and organized.

It is up to the librarian and teachers to recognize that learning a systematic approach for critical thinking should be implemented at any early stage in the education of students. Students in grades four and up can start learning about research and problem solving; the research can include information about

the card catalog, the classification of books, preparing a research report, and building a bibliography. However, it is important to remember that a project must be relevant, attractive, and appropriate for the particular age group it has been assigned to. The research can be done in a group or on an individual basis, depending on the skill level or assignment. Remember that the concept itself whould follow a systematic thought process, because students will use this process for the rest of their lives.

Media specialists need to support the teacher during research for projects; they should provide the time to help students find research material, and if the material is not at their library, direct the students to a place which will have the needed information. Unfortunately, librarians do not have the chance to see the finished product. It is up to the librarian to create the chance for everyone to see the projects that students have put so much time and effort into.

At University High School the science students exhibit their work in the media center where faculty, peers, parents, administrators, and the community can look at the projects. The awareness of the science exhibit is increased by having it covered by the local media.

Excellent Books for Famous Mathematicians Research

Reimer, Luetta and Reimer, Wilbert, Mathematicians are People Too. Dale Seymour Publications Palo Alto, CA. 1990

Women

Olsen, Lynn M. Women in Mathematics. The MIT Press 1974

Perl, Teri. Math Equals. Addison-Wesley Publishing Company: Massachusetts, 1978.

Campbell, Paul J and Grinstein, Louise S. Women of Mathematics. Greenwood Press: New York, 1987

Marquis. Who's Who in Science. Western Publishing Co. 1968

Eves, Howard W. In Mathematical Circles. Prindle, Weber, and Schmidt, Inc.: 1969

Men

Bell. E. T. Men of Mathematics. Simon and Schuster, New York. 1965

Abbot, David. The Biographical Dictionary of Scientists and Mathematicians. Great Britain: Blond Educational, 1985

Newman, James. The World of Mathematics. New York, 1956

Smith, David. History of Mathematics. Boston, 1925

Mathematics. LIFE Science Library.Time, Inc. 1963

Hollingdale, Stuart, Makers of Mathematics. Penguin Books. London: 1989

Special books or articles on certain People

Hopper, Commodore Grace Murray, Understanding Computers.West Publishing Co. St. Paul, 1984

Billings, Charlene W. Grace Hopper, Navy Admiral and Computer Pioneer. New Jersey, Enslow Publishers, Inc. 1989

Hall, Bettye,Algebra II with Trigonometry. Grace Murray Hopper,Prentice Hall,New Jersey,1990

"The Grand Old Lady of Software, Newsweek, 9 May 1983,p.13-14
"Admiral Hopper talks to AAAS Staff." Science. 5 Sept. 1986:1095-6

Brewer,James W. and Martha K. Smith, Emmy Noether: a tribute to her life and work. New York: Marcel Dekker Inc. 1981

The Joy of Math, or Fermat's revenge. Time. April 18, 1988

Fibonacci,Leonardo Pisano, The Book of Squares. Academic Press 1987 Translated by L.E. Sigler, p XV-XX

Davidson, Hugh , Blaise Pascal 1983, Indiana Unv. Press, Bloomington, Ind.

Sorel, Nancy. " Blaise Pascal and Rene Descartes." The Atlantic Monthly. January 1991

Glimm, James. The Legacy of John von Neumann. New York, NY, American Mathematical Society, 1990

Hoffman, Paul. " Fermat still has the last laugh." Discover January 1989

W.K. Buhler. Gauss- A Biographical Study. New York: Springer-Verlag 1981

Gaukrogerf, Stephen. Descartes: Philosophy, Mathematics, and Physics,c. 1980, The Harvester Press LTD. pp. 23-40